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An unusual case of large left ventricular aneurysm: Complementary role of echocardiography and multidetector computed tomography in surgical planning

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Abstract

We report a case of a 68-year-old man in whom myocardial infarction was complicated by a large and unusual left ventricular aneurysm. Peculiar anatomic features of a very large aneurysm of the posterior wall of the left ventricle were clearly suspected on transthoracic and transesophageal echocardiography and precisely defined through multidetector computed tomography. This technique not only confirmed echocardiographic findings, but also facilitated the differential diagnosis between left ventricular aneurysm and left ventricular pseudoaneurysm and the choice of the correct surgical planning.

Keywords: Heart; Left ventricle; Aneurysm; Computed tomography; Echocardiography

1. Introduction

Left ventricular aneursym (LVA) and left ventricular pseudoaneurysm (LVPA) are serious complications of acute myocardial infarction (MI) [1]. LVA is composed by thinned area of scarred myocardium that move dyskinetically [2,3], while left ventricular pseudoaneurysm (LVPA) forms when cardiac rupture occurred, is contained by adherent pericardium or scar tissue, does not contains endocardial and myocardial cells, and is characterized by a narrow neck diameter and it could give rise more frequently to rupture [4–6]. Usual sites of LVA are apical and anterior segments, while LVPA involves more frequently the postero-lateral segments.

Because of the high risk of rupture, LVPA requires surgical treatment [6–8], while surgical indications of LVA include heart failure, angina pectoris, malignant ventricular arrhythmias or recurrent embolization [1].

We describe the case of an unusual very large aneurysm of the posterior wall of the LV in which multidetector computed tomography (MDCT) data associated with echocardiographics findings facilitated the differential diagnosis between LVA and left ventricular pseudoaneurisym (LVPA) and provided the visualization of all anatomical details for the correct surgical planning.

2. Case report

A 68-year-old patient was admitted to our hospital because of heart failure. Two months before he was admitted to another hospital for chest pain and an inferior-posterior myocardial infarction was diagnosed. During this first admission cardiac catheterization showed an occlusion of the right coronary artery and a severe stenosis of the mid-left

Abbreviations: LVA, left ventricular aneurysm; MDCTmultidetector computed tomography; LVPA, left ventricular pseudoaneurysm; MI, myocardial infarction; HFheart failure; ECG, electrocardiogram; TTE, transthoracic echocardiogram; TEEtransesophageal echocardiogram; VRvolume rendering; LAD, left anterior descending artery; RI, ramus intermedius; IMA, internal mammarian artery; AMIacute myocardial infarction

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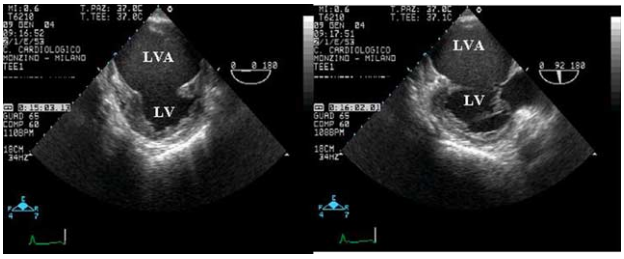

Fig. 1. Short axis (left) and long axis (right) in transgastric position view by TEE. LV: left ventricle; LVA: left ventricular aneurysm.

anterior descending artery that was treated by percutaneous transluminal coronary angioplasty and stent implantation. LV angiography and echocardiography demonstrated moderate LV systolic dysfunction and akinesia of the LV inferior wall. Two months later, the patient underwent to a transthoracic echocardiogram because of dyspnea. The examination showed the presence of a large cavity in the inferior wall of the left ventricle, and the patient was transferred to our hospital.

The patient was in NYHA functional class III, the chest X-ray showed enlargement of the LV profile, and the electrocardiogram showed sinus rhythm, Q wave with ST elevation and negative T waves in the inferior leads.

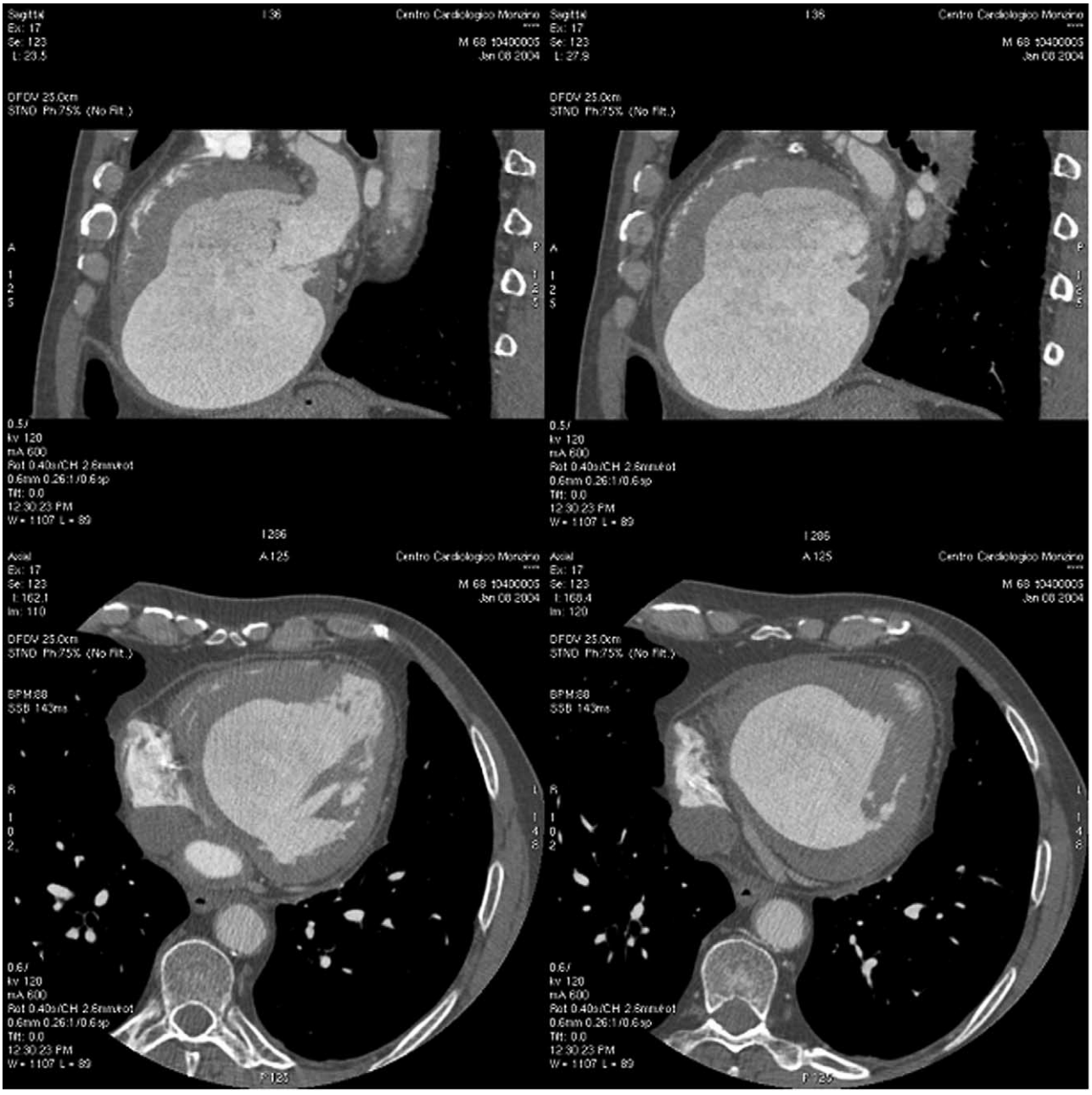

Fig. 2. Long axis view (upper) and axial view (lower) of the aneurysm by multidetector computed tomography (MDCT).

Transthoracic echocardiogram (TTE) (Philips 5500, model 21364A, Andover, MA, USA) demonstrated a large akinetic cavity in the inferior wall of the left ventricle, with a very wide neck, which extended from the mitral anulus to the left ventricular apex. Severe mitral regurgitation and marked LV systolic dysfunction (ejection fraction < 30%) were also associated. Transesophageal echocardiography (TEE) confirmed the presence of a large inferior cavity. The globular profile of the cavity and its neck were very close to the base of the papillary muscles and to the mitral anulus. Severe functional mitral regurgitation with an anatomical normal mitral valve apparatus was also confirmed. Even though the neck was wide, marked thinning of the cavity wall and discontinuity of the endocardial border posed a differential diagnosis between a LVA or LVPA (Fig. 1).

To better define the pre-operative characteristics of this cavity the patient underwent a multidetector chest computed tomography (MDCT) scan (GE 16 slices, rotation time 0.4 s, collimation 0.625 mm) that demonstrated a very large inferior-posterior cavity of 10 cm × 6 cm, with a large neck (approximately 5 cm; wall thickness 3 mm). The wall was almost regular and appeared to be composed by pericardium and a very thin scar tissue (Fig. 2). Volume rendering (VR) reconstruction further clarified neck diameter and location of the LV cavity (Fig. 3).

Coronary angiography revealed a 75% stenosis of the left anterior descending artery (LAD), subocclusion of a ramus intermedius and occlusion of the right coronary. LV angiography confirmed a giant cavity arising from the inferior wall of the LV and severe mitral regurgitation.

The patient underwent surgery: the aneurysm was widely opened during aortic cross-clamping and cardioplegic cardiac arrest, and a double (Dacron plus autologous pericardial) circular patch was sutured to the ventricular rim taking care to avoid excessive traction on the myocardium or distortion of the circumflex artery [9,10].

Myocardial revascularization by internal mammarian artery (IMA) on LDA and venous graft on the ramus intermedius and mitral valvuloplasty completed ventricular repair.

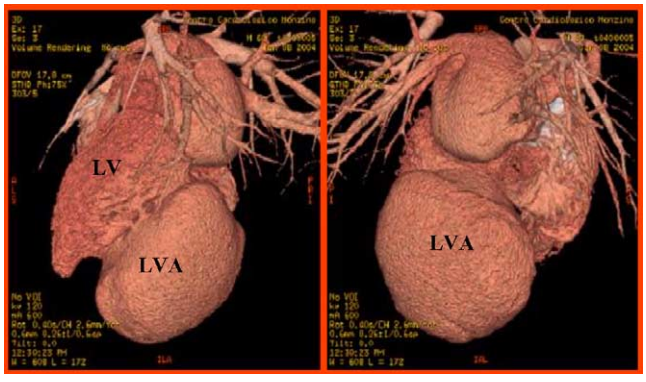

Fig. 3. Volume rendering (VR) reconstruction of the left ventricular aneurysm. Left view (left) and posterior view (right). LV: left ventricle; LVA: left ventricular aneurysm.

The patient tolerated very well the procedure and was weaned from cardiopulmonary bypass with a low dose of inotropic support.

A piece of the excised wall was then examinated. The histopathological evaluation showed a thin portion of fibrous tissue covered by several fat cells and small vessels and few anuclear myocardial cells. These findings supported the diagnosis of a large ventricular aneurysm.

The patient was discharged from the hospital in NYHA class I and he is asymptomatic at 2 months follow-up.

3. Discussion

True LVA and LVPA are serious complications of acute myocardial infarction (AMI). LVA occurs months or years after AMI, infrequently undergo progressive and rapid expansion or rupture and contains three layers of the myocardium and frequently mural thrombus. LVPA is a contained myocardial rupture that occurs days or months after AMI, progressively expands, does not contain the layers of the myocardium and have a tendency to rupture [1]. Both complications are more frequently located in the anterior-apical or inferior-lateral walls of the LV, but large LVA are more frequently seen at the ventricular apex [2,11]. By different imaging technique the entrance or neck of the LVPA is narrow in relation to the size of the cavity and this is in contrast to the wide opening into the true aneurysm.

This is one of the first descriptions of the complementary role of echocardiography and MDCT in the diagnosis of an unusual and giant inferior LVA occurred 2 months after an AMI and successfully repaired surgically.

The location of the cavity, its rapid progression, its size and sharp discontinuity of the endocardial image with saccular contour of the cavity, as well as the very thin wall could be in favour of a very large LVPA, while the large neck orientated to the diagnosis of LVA. Echocardiography described correctly the site and size of the cavity, and gave also complete surgical information regarding the mitral valve apparatus (which was anatomically normal) and the mechanisms of mitral regurgitation (functional mitral regurgitation), while both transthoracic and transesophageal techniques did not differentiate LVA from LVPA. MDCT not only confirmed these echocardiographic findings but also allowed a very accurate description of the anatomy of the LV. Wall thickness (4 mm), its anatomical characteristics (regular expansion of the cavity with the pericardium surrounding myocardial scar) and the absence of a rapid discontinuity of the endocardial wall were unique signs of LVA. Moreover volume rendering reconstruction detected small epicardial vessels that are not seen in LVPA. Pathological findings completely matched with MDCT data. Histopathological evaluation showed a very thin wall of fibrous tissue covered by fat cells and anuclear myocardial cells and pericardial tissue. This case underlies the role of the MDCT in defining cardiac anatomy as an alternative imaging technique with results very simi-

lar to cardiac magnetic resonance, which is considered very accurate in providing size and location of aneurysm and pseudoaneurysm [12].

Clinical data and dimensions of the cavity were extremely unusual in this case. LVA occurs rarely immediately after the acute phase and the LVA cavity expands progressively after several months or years. In parallel remodeling of the LV and LV dysfunction associated with mitral regurgitation may further facilitate the onset of signs of heart failure. In our case 2 months before the admission in our hospital LV angiography and echocardiography did not show any evidence of LV remodeling or LVA. The right coronary artery was occluded and only a LAD PTCA was performed. The absence of early reperfusion and poor collateral flow after an AMI may contribute to the propensity of all mechanical complications of MI. However rapidity (2 months) of the evolution of this giant (10 cm × 6 cm) LVA of the inferior wall has not a clear pathophysiological reason.

Surgical planning was based on the two techniques and on coronary angiography. Surgical inspection confirmed echocardiographic and MDCT data concerning the relationship between the LVA cavity, its neck, the papillary muscles and mitral valve anulus. As clearly shown in Fig. 3 the globular profile of the cavity and its neck were very close to the base of the papillary muscles which were normal and to the mitral anulus. Therefore mitral anuloplasty was associated with a resection of the LVA and remodeling of the LV cavity through an endoventricular patch. Coronary bypass was also associated. Remodeling of the cavity and resolution of mitral regurgitation was associated with an excellent clinical result both in the acute phase and at 2 months follow-up.

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